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EXAMINER	
CHEN, WENPENG	
ART UNIT	**PAPER NUMBER**
2624	

DATE MAILED: 05/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/766,121	LIU, CHENGJUN	
	Examiner	Art Unit	
	Wenpeng Chen	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 January 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7 and 10-26* is/are pending in the application.

4a) Of the above claim(s) *17-26* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7 and 10-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 January 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/7/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Examiner's responses to Applicant's remark

1. Applicant's arguments and amendments filed on 1/18/2005 have been fully considered.

-- Applicant's argument with regard to paragraph 1 of Office Action mailed on 8/26/2004 is persuasive.

-- Applicant's amendments overcome the followings set forth in Office Action mailed on 8/26/2004: (1) objection to drawing, (2) objection to specification, (3) objection to Claims 8-12, and (4) rejections to Claims 2-7 and 10-12 under 35 U.S.C. 112, second paragraph.

2. Applicant's arguments with regard to the art rejections are not persuasive.

a. Applicant's argument -- Applicant recites vector n Claim 10, not feature. Yang teaches features. Therefore, Yang does not teach the DFA vector recited in the limitation of "wherein the PDFs of the face and nonface classes are calculated only after first calculating a DFA (Discriminating Feature Analysis) vector of each of a plurality of training images" in Claim 10.

Examiner's response -- The Examiner cited section 2.4.2 of right column, page 43 and left column, page 44 (not section 2.2.4) to teach this feature. In section 2.4.2, a 19 x 19 pixel image is treated as a 361-dimensional vector. Data of each pixel is a feature of the image. Because each pixel contributes in discriminating a face from a nonface, each pixel data is a discriminating feature. The vector made from the pixels is thus a DFA vector.

b. Applicant's argument -- With regard to rejections to Claims 1-7 under 35 U.S.C. 103(a), (1) to establish a prima facie case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. However, the Office Action has not identified any suggestion for the proposed combination of features of Yang in the reference. (2) In the remarks, the Applicant argued that the claims do not recited "edge representation." So the "edge representation" cited in the previous Office Action is not relevant to the claims.

Examiner's response -- For point (1), the Applicant clearly pointed out that the motivation of improvement can come from the knowledge generally available to one of ordinary skill in the art, not necessary from the cited reference. It is actually the case for the combination set forth in the previous Office Action.

For point (2), the edge information is relevant. As shown in Fig. 2 of the present application (also see section 3.1 of the provisional application), the 1D vertical and horizontal Harr representations corresponds to the vertical and horizontal difference images, respectively. It is known to one of ordinary skill in the art that a vertical and horizontal difference images represent the corresponding vertical and horizontal difference edge maps of an image, respectively.

As explained above, any data is a feature data of an image in a broad sense. An ordered set of the data that can discriminate an object forms a discriminating feature vector.

c. Applicant's argument -- With regard to rejections to Claims 1-7 under 35 U.S.C. 103(a), Yang and Go are not analogous for combination because Yang's edge information is for classification while Go's 1D Harr algorithm is for coding.

Examiner's response -- The Examiner disagrees with this conclusion. Both Yang and Go are directed to derive the same information from an image, i.e., the edge maps of an image. The Examiner does not rely on Go to teach classification of images. Go's teaching is to provide a common known method to determine edge information. Yang does not specify any preferred approach for determining an edge map. Any disclosed approach for deciding edge map facilitates the implementation of Yang's method to one of ordinary skill in the art because one does not need to develop his own method. Although the end application of Yang and Go are different, the part of edge information determination disclosed by Yang and the part of 1D Harr algorithm disclosed by Go all aim at solving the same image-processing problem. Therefore, the cited parts are analogous and the combination is proper.

Claim Objections

3. Claims 26-27 depend from a non-existed Claim 25.

4. The numbering of claims is not in accordance with 37 CFR 1.126 which requires the original numbering of the claims to be preserved throughout the prosecution. When claims are canceled, the remaining claims must not be renumbered. When new claims are presented,

they must be numbered consecutively beginning with the number next following the highest numbered claims previously presented (whether entered or not).

The amendment filed on 1/28/2005 does not have Claim 25. Therefore, Claims 26-27 become misnumbered. Misnumbered claims 26-27 have been renumbered as 25-26.

Election/Restrictions

5. Newly submitted claims 17-24 and the renumbered 25-26 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons.

6. The pending claims are directed to two distinct inventions:

I. Claims 1-16, drawn to classifying images as shown in Fig. 1, classified in class 382, subclasses 159 and 228.

II. Claims 17-24 and the renumbered Claims 25-26, drawn to special search method for face as shown in Figs. 13(a) and (b) of the corresponding provisional application 60/446,596, classified in class 382, subclass 226.

7. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as subcombinations disclosed as usable together in a single combination. The combination searches face through a sequential search with statistical decision

based on face and non-face models. The subcombinations are distinct from each other if they are shown to be separately usable. In the instant case, invention I has separate utility such as separating images of faces from non-face images without the need of searching faces in an image such for picture sorting; while invention II has separate utility such as search face through a sequential search with template matching without involving statistical process, such as locating a particular person with a known face template. See MPEP § 806.05(d).

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

8. Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 17-24 and the renumbered 25-26 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Drawings

9. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the features of claims 17-24 and the renumbered 25-26 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered. No drawings are related to the above listed claims.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

10. The specification is objected because there is no explicit support or reference for claims 17-24 and the renumbered 25-26. The support is in the incorporated provisional application 60/446,596.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

12. Claims 10-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Yang et al. ("Detecting Faces in Images: a Survey," Yang, Ming-Hsuan et al., IEEE Trans. On Pattern Analysis and Machine Intelligence, v. 24, no. 1, January 2002, pages 34-58 cited previously.)

Yang teaches a method of classifying an input images as being of a first type or of a second type, the method comprising:

-- calculating Gaussian PDFs (Probability Density Functions) of images classes of said first type and of said second type using a single multivariate Gaussian PDF,

- wherein said first type is a face and said second type is a nonface; (left column, page 43 teaching two types of image, a face and a nonface; section 2.4.2 from right column, page 43 to left column, page 44 teaching the Gaussian PDF)

-- utilizing said Gaussian PDFs in conjunction with at least one input image to classify said input image as either being of a first type or of a second type; (section 2.4.2 from right column, page 43 to left column, page 44)

-- wherein the PDFs of the face and nonface classes are calculated only after first calculating a DFA (Discriminating Feature Analysis) vector of each of a plurality of training images; (DFA being generated at first in section 2.4.2 of right column, page 43, then PDF's being calculated in left column, page 44)

-- wherein a DFA vector of an input image is calculated and a Bayesian discriminator function is used to process the DFA vector of the input image to classify said input image as either a face or nonface; (section 2.4, left column, page 43)

-- wherein said PDFs of the face and nonface classes are calculated during training based upon a sample set of at least several hundred FERET images. (section 3.1, page 49)

13. Claims 13-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Sung et al. ("Example-Based Learning For View-Based Human Face Detection," Sung, et al., IEEE Trans. Pattern Analysis and Machine Intelligence, Vol. 20, No. 1, January 1998, pp. 39-51 cited in IDS filed on 4/7/2005.)

Sung teaches a method, comprising:

-- modeling a face class of images, wherein images outside said face class of images are nonfaces within a nonface class; (section 2.4.2; Fig. 4; Fig. 4 clearly shows that nonfaces are outside face classes.)

-- modeling a subset of said nonfaces which lie closest to said face class, wherein said nonfaces in said subset are support nonfaces; (section 2.4.2; Fig. 4; The nonface patterns that are wrongly classified as faces are the nonfaces which lie closest to said face class. It obvious that the "false positive" patterns are those closest to the faces patterns. They are support nonfaces.)

-- wherein said support nonfaces are closest, among said nonfaces in said nonface class, to a decision surface between said face class and said nonface class; (section 2.4.2; Fig. 4; The 12 pairs of distances associated with face and nonface clusters are used to classify face window patterns form nonface window patterns. The relation defined by the distances define a surface in the multiple dimensional feature space.)

-- wherein said modeling said support nonfaces comprises: modeling support nonfaces as a multivariate normal distribution; (section 2.4.2; Each nonface cluster is represented by a multivariate normal distribution. A Gaussian distribution is a normal distribution.)

-- estimating a conditional density function of said nonface class using a plurality of principal components, an input image, a mean nonface value, and eigenvalues of said nonface class. (section 2.4.2; The density estimation is done with regard to PCA, the input of the nonface images, the mean image and a covariance, and eigenvalues of the nonface class. The 75 eigenvectors are selected as the eigenvectors having the largest 75 eigenvalues. This is the method perform in a PCA (Principal component analysis).)

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang et al. ("Detecting Faces in Images: a Survey," Yang, Ming-Hsuan et al., IEEE Trans. On Pattern Analysis and Machine Intelligence, v. 24, no. 1, January 2002, pages 34-58) in view of Go (US patent 5,761,341 cited previously.)

Yang teaches a method of representing an image comprising:

-- obtaining an image; (right column, page 43, section 2.4.2; last paragraph, right column, page 45)

-- calculating its edge representation and amplitude projections; (last paragraph, right column, page 45; left column, page 37 and Fig. 3)

-- using the image, edge representation, and amplitude projections as features for face recognition; (first paragraph, section 2.2.4 "Multiple features; left column, page 43)

-- combining several features for facial recognition. (first paragraph, section 2.2.4 "Multiple features; right column, page 45)

However, Yang does not explicitly teach combining all the image, edge representation, and amplitude projections as features for face recognition.

It is desirable to improve accuracy of facial recognition. This objective can be achieved by combining various features as discriminating components. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to combine all the image, edge representation, and amplitude projections that appear in different portions of Yang's paper as features for face recognition because this combination improves accuracy of facial recognition.

Furthermore, however such an obvious extension of Yang's teaching does not teach using 1-D Haar wavelet representation of the image as features for facial recognition.

Go teaches using 1-D Haar wavelet to derive edge images in both vertical and horizontal directions. (column 7, lines 1-50; Please note that Go's equation in line 5, column 7 is the same as equation (1) of '596 application. The images generated by Go thus are 1-D Haar wavelet representations of the image in the vertical and horizontal directions.)

It is desirable to be flexible in processing image for facial recognition. Because 1-D Haar wavelet operation is one of edge determining processes, it would have been obvious to one of ordinary skill in the art, at the time of the invention, to include 1-D Haar wavelet operation to

generate Yang's edge maps as part of feature vector because this combination provides process flexibility.

The combination thus teaches:

-- calculating 1-D Haar wavelet representation and amplitude projections of an image;

-- combining said image with said I-D Haar representation and said amplitude projections.

Yang further teaches in the method the following features:

-- wherein said combining includes forming a discriminating feature analysis (DFA) vector of said image; (right column, page 43; The feature vector is normalized and presented with respect to the mean image. The vector is thus a DFA vector.)

-- wherein a plurality of DFA vectors are formed based upon training images; (section 2.4.2; the learning process being inherently based on training images)

-- wherein said DFA vectors from said training images are used to model face and non face classes using a single multivariate probability distribution function (PDF) for each of said face classes; (left column, page 43 teaching two types of image, a face and a nonface; section 2.4.2 from right column, page 43 to left column, page 44 teaching the Gaussian PDF)

-- wherein said models are stored and used for later analysis of input images; (right column, page 43; Comparison is made between an input image and the prototype clusters. The prototype clusters are the models.)

-- calculating a DFA of an input image to be analyzed; (right column, page 43; Comparison is made between an input image and the prototype clusters. The DFA of the input image has to be calculated before the comparison.)

-- using said DFA vectors of said input image to classify the image using a Bayesian classifier. (section 2.4, left column, page 43)

Conclusion

16. THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). The Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wenpeng Chen whose telephone number is 571-272-7431. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K Moore can be reached on 571-272-7437. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9306 for regular

communications and 703-872-9306 for After Final communications. TC 2600's customer service number is 571-272-2600.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-2600.

Wenpeng Chen
Examiner
Art Unit 2624

May 23, 2005